**In the United State Patent and Trademark Office**

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| Appn. Number: | US 10/599,555 national phase entered on October 1st, 2006 |
| International Appn Nr. : | WO 2005/109985 / PCT/EP2005/051404 |
| Applicants: | Robert Desbrandes, Daniel L. Van Gent |
| Tittle : | METHOD AND DEVICE FOR MODIFYING THE DEEXCITATION PROBABILITY OF NUCLEAR ISOMERS |

Examiner: Mr. Brooke PURINTON

Givarlais, France, 2010 September 20th

**Answer to Final action mailed 06/23/2010**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir,

I would like to thank you for the examination my application.
However, it appears that I have been mistreated regarding the action dated December 30th, 2009, and the final action dated June 23rd, 2010 because of the following reasons:
The final action states that "*Applicant's arguments with respect to claims 1-5, 8-17, 19-42 have been considered but are moot in view of the new ground(s) of rejection. Furthermore, examiner apologizes but the statutory response period of one month for restrictions cannot be altered, since it is a legal issue, and non-discretionary*."
Indeed, the prosecution history shows the following:

- First, a delay of 1 month or 30 days whichever is longer was given in the action dated December 30th, 2009, while the action cited 4 patents opposed to claim 2 "*The features of Claim 2, which are shown in Fehsenfeld (5674177), Hektner (6019718), Hastings (5855546) and/or Crocker (5782742), lack novelty or an*

*inventive step and do not contribute over the prior art.* " Such an action is an **action on the merits of the application**, and should have been given **at least 3 months** considering the volume and the complexities of the patents opposed. Moreover, the action which opposed the 4 patents did not specifically pointed to any specific paragraphs of the patents, which put a heavy burden on the applicant in order to analyse each of these patents in details, in view of claim 2. The grounds were very vague ("*lack novelty or an inventive step*") with no specific reasoning, which would have allowed the applicant to anticipate future new grounds of objection of the final action to come;

- Second, the examiner did not acknowledged whether the 4 patents are still opposed, or not, making it difficult to amend the claims;
- Thirdly the final action states: "*Applicant's arguments with respect to claims 1-5, 8-17, 19-42 have been considered but are moot in view of the **new** ground(s) of rejection*" [bold added]. It is not fair to introduce new grounds against previous arguments without allowing the applicant an opportunity to answer to such new grounds.

Hence, we were given a mere one month delay while the action was substantially an action on the merits of claim 2, and then we were delivered a final action with new grounds of objection and on the basis that the 1 month delay was for restriction and cannot be altered.
Moreover, the applicant being an inventor pro se, the Office usually provides to such category of applicant some guidance.

Concerning the claim rejections under 35 USC 103:

In the final action, claim 1 is interpreted as having a variable half life due to the mixing of gamma's of two energies, but the man skilled in the art knows that gamma measurement devices are multi-channel analysers, which measure the number of gamma received at each possible discrete energies, thus providing a spectrum composed of characteristic lines of the deexcitation of one or more sort of isomer nuclides being in a metastable state. For example the measurements of the gamma emitted by Indium, which were given in our letter dated 2008 December 14th corresponded to 336.2 keV characteristic line, and the initial variable half life is computed for this sole characteristic line to 130 minutes, instead of the well known

reference constant half life of 268 minutes for Indium 115m. The man skilled in the art knows that if two metastable nuclides, each having an energy line, are mixed, each line measured using a multi-channel analyser, has a constant half life which can be determined.

It is stated that the broadest interpretation of former claim 1 should be made considering former claim 8 (mixing two metastable isomers obtained according to the invention) and consequently that the variable half life of the claimed metastable isomer is obvious for the one skilled in the art, which would have combined the teaching of Herlein et al (5674177), Tam et al. (6685618), and Baldwin (3234099), which mixes two radioactive nuclides, one having a short half life and one having a long half-life to obtain a variable half life, the same for metastable nuclides being considered obvious.
However, the point here is that the teachings of the application are misrepresented by such a broadest interpretation : a metastable nuclide de-excites by emitting gammas in one or more characteristic lines of energies: a Germanium gamma counter measures each characteristic line of energy, thus measuring a spectrum of the energies with the counts available for each different line of energy over time.
Hence, the teachings of this invention are clearly understood by one skilled in the art: one has the ability to clearly distinguish whether a characteristic line of energy is de-exciting with a constant half life (as has always been assumed by the overall community of those working in this domain), or whether one of the characteristic line of energy presents a variable half life over time.
<u>The claims have been re-written in order to clearly state that the half-life of at least one characteristic energy line is variable over time.</u>

<u>Concerning claim rejections under 35 USC §112:</u>
The technique to photoactivate isomer nuclides is well known, but apparently after decades of interest while the gamma energies available where very low, the techniques were not investigated using high energy gamma produced by the Bremsstrahlung of accelerated electrons. This state, coupled with prejudices against the possibility of the invention (namely the possibility of a variable half life of a characteristic line of energy for a standalone excited metastable nuclide), and the need to associate various fields of knowledge has prevented the occurrence of this princep invention.

Dr. Van Gent and I, have been photoactivating isomer nuclides on a trial basis although there was general knowledge amongst the ones skilled in the art. Hence, following your final action, I have made a search in the French Sciences Academy in order to determine what was already well known about metastable nuclides. It appears that the domain was thoroughly investigated at least since 1939 till the seventieth and somehow put aside later on, since it was considered quite known with predictable energy levels, and detailed isomer nuclides tables with the energies radiated and the corresponding half lives, all such energies being listed with their probabilities and being assumed to be of constant half lives whatever the considered process of making the excited metastable isomers.

We would like to complete the state of the art in the application by the following references:

[8] Firestone R. et al., "*Table of Isotopes*", Eighth Edition, 1996, Wiley Interscience.

[9] Pontecorvo B., and Lazard A., "*Nuclear Isomerism produced by X-rays of the continuous spectrum*", Compte Rendus, French Academy of Sciences, 1939, pp. 99-101.

[10] Boivin M., Cauchois Y., and Heno Y., "*Nuclear photoactivation of 77Se, 107,109Ar, 111Cd, 115In, and 199Hg*", North-Holland Publishing Co., Amsterdam, Nuclear Physics, A137 (1969), pp. 520-530.

[11] Veres A., "*Photo-activation if Cadmium-111m and Indium-115m by Cobalt-60 irradiation*", International Journal of Applied Radiation and Isotopes, 1963, Volume 14, pp. 123-128, Pergamon Press Ltd.

Documents [9], [10] and [11] are submitted in the attached IDS with the English translations I have made for [9] and [10].

Mrs Cauchois in [10], studied extensively the photoactivation of a series of metastable nuclides (77Se, 107,109Ar, 111Cd, 115In, and 199Hg) using an accelerator producing accelerated electrons up to 2 MeV (usually referred as KVp). This document illustrates the state of the art in photoactivation of isomer nuclides.

It is shown that an isomer nuclide can be photoactivated according to a pattern which applies to all isomer nuclides: Figure 1 of [10] shows that an isomer nuclide has a set of energy gateways at which gamma rays photoactivate the isomer nuclide. The

photoactivated isomer nuclides then cascade to the metastable state as can be viewed in the Table of Isotopes [8] for the various isomer nuclides. In fact the energy gateways found in [10] are energy levels now listed in the Table of Isotopes [8] as illustrated for the characteristic lines of energy of Indium 115 (see the diagram below).
Mrs Cauchois in [10] determined the photoactivation gateways, and their respective approximate yields, as shown in Table 4 for Indium 115:

- First identified photoactivation gateway energy is at 600 [+/-10] keV (the leading 0 is a typographical error) with a yield of the order of 2 $10^{-7}$
- The second identified photoactivation gateway energy is at 830 [+10/-30] keV with a yield of the order of 1.3 $10^{-7}$
- The third identified photoactivation gateway energy is at 935 [+/-10] keV with a yield of the order of 0.02
- The fourth identified photoactivation gateway energy is at 1070 [+/-10] keV with a yield of the order of 0.3
- The fifth identified photoactivation gateway energy is at 1490 [+10/-20] keV with a yield of the order of 2.

This pattern of the photoactivation gateway energies, and corresponding yields, are very similar for each of the isomer nuclides.
The accelerator used in [10] produces by Bremstrahlung a spectra of gamma of energies up to 2 MeV. It is known to the one skilled in the art that the sum of the energies of gamma rays produced by the Bremsstrahlung of one accelerated electron is less or equal to the energy of the electron on the target: accordingly it is obvious from our specification that the sum of the energies of entangled gamma rays is less than KVp, which is dependant upon the tuning of the accelerator used.
It shows that while Mrs Cauchois in [10] was able to determine the photoactivation gateway energies and yields, she was unable to produce significantly the entangled isomer nuclides, due to the pattern of the yields, and because of the upper KVp of her accelerator:

- While irradiating with a KVp less than 600 keV, there was no photoactivation.
- While irradiating with a KVp from 600 keV to 830 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the

first photoactivation gateway (600 keV), thus producing the regular metastable nuclide with an extremely low yield.

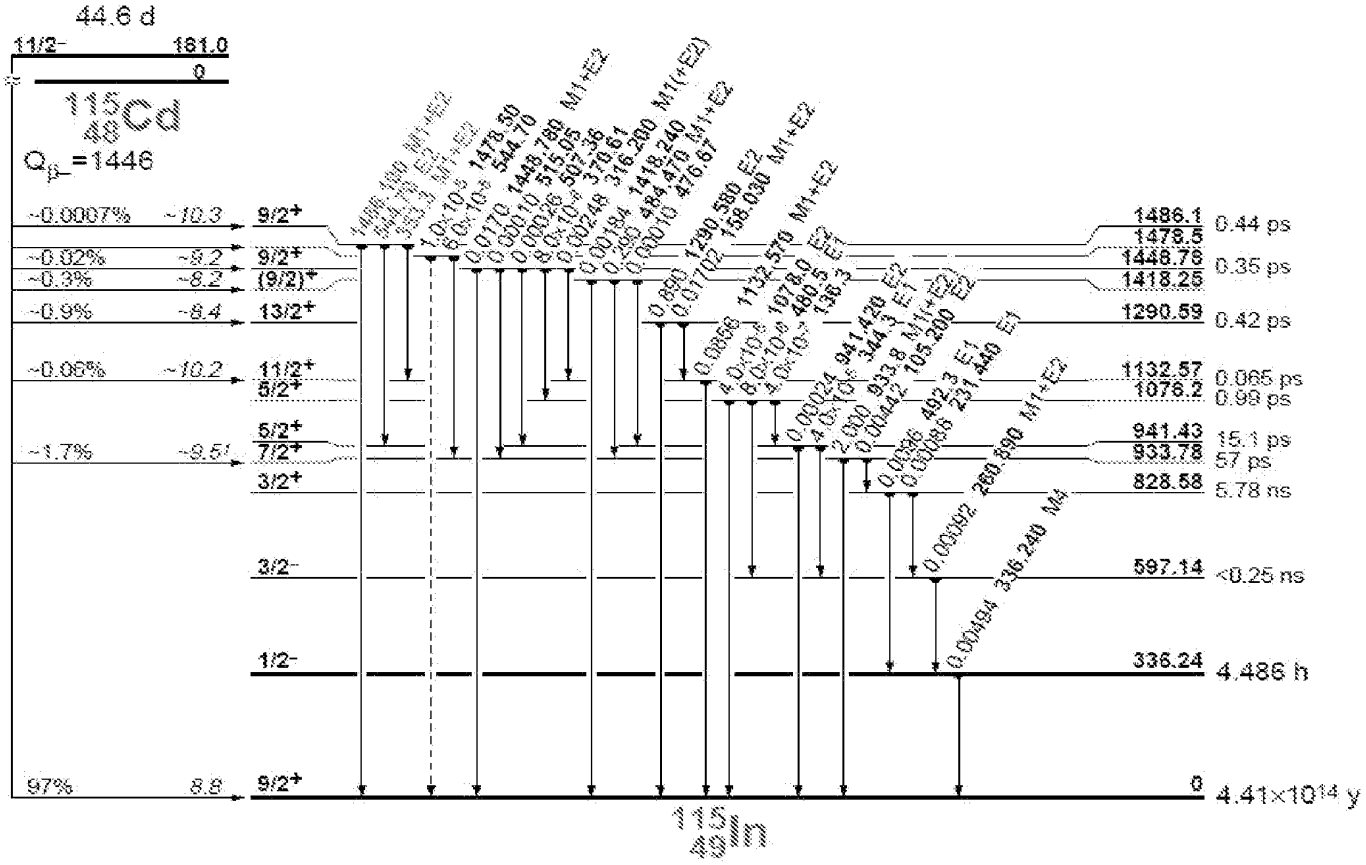


Diagram of the metastable levels of Indium 115 (from document [8])

- While irradiating with a KVp from 830 keV to 935 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with an extremely low yield.
- While irradiating with a KVp from 935 keV to 1070 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with an extremely low yield of 0.02.

- While irradiating with a KVp from 1070 keV to 1200 keV, the Bremsstrahlung did not produced groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV), thus still producing the regular metastable isomer nuclide with a medium yield of 0.3.
- While irradiating with a KVp from 1200 keV to 1490 keV, the Bremsstrahlung did produced some groups of two entangled gamma rays with energies higher than the first photoactivation gateway (at 600 keV). However, because the yield of the first photoactivation gateway (at 600 keV) is about one millionth of the yield of the fourth photoactivation gateway (at 1070 keV), the percentage of entangled nuclei in the metastable isomer was insignificant, thus still producing a nearly regular constant half life of the metastable nuclide.
- While irradiating with a KVp from 1490 keV to 2000 keV, the Bremsstrahlung did produced some groups of two entangled gamma rays with energies higher than the first, second and third photoactivation gateways. However, because the yield of these photoactivation gateways (at 600, 830 and 935 keV) are less than one hundredth of the yield of the fifth photoactivation gateway (at 1490 keV), the percentage of entangled nuclei in the metastable isomer was insignificant, thus still producing a nearly regular constant half life of the metastable isomer nuclide.

The same pattern has occurred with the other isomer nuclides. Hence, Mrs Cauchois in [10] has not detected a variable half life. In fact the half life might have varied by less than 1%, which she was not able to detect.
Hence, the product according to the invention might have been made only if Mrs Cauchois could have used KVp of 2150 keV and up, although with a very low variation of half life until the threshold of 2980 keV (twice the fifth photoactivation gateway energy).

Concerning document [11], it appears that Indium 115 and Cadmium 111 have been irradiated using a Co60 source of 424 c. : however, the variable half life has not been reported for the following reasons:

- The initial variable half life has not been measured: the first measured value for Cd111m has been made at 20 minutes as compared to the half life of 49 minutes, the first measured value for In115m has been made at 1 hour and 10 minutes as compared to the half life of 4.48 hours. Moreover, the measurements

were imprecise: approximately +/- 8% for In 115m and +/- 7% for Cd 111m. Hence, the initial variable half lives of the products has not been seen by the author. Moreover, the author reports a constant half life of 4.5 hours for In 115m in Figure 5 over 30 hours, and a constant half life of 49 minutes for Cd 111m in Figure 7 over 160 minutes.

- These above imprecisions and the time for the first measurements do not contradict our own measurements as our In 115m product made by Co60 would display a reduction of half life less than 8% after one hour and 10 minutes.

Hence, it may be that In 115m and Cd 111m made by Co60 irradiation were disclosed by inherence in [11], although the variable half life property had not been reported. However, higher reduction in variable half life has not been disclosed by inherence.

In fact, it appears that the community of researchers did not test photoactivation for high kVp in using Bremsstrahlung. There may have been less interest in the photoactivation techniques, which were well known to the one skilled in the art, coupled with prejudices against the possibility of the present invention. Another factor for the research community to have missed such a an extraordinary invention, at least in terms of the general theories of physics, may be that other irradiation techniques might have been used to pursue researches in photoactivation of isomer nuclides.

In the specification, we disclosed :

- The entangled Indium 115 produced by Co60 irradiation having an initial half life of 242 minutes instead of the reference constant half life of 268 minutes, which is a reduction of 9.7%.
- The entangled Indium 115 produced by the Bremsstrahlung irradiation from 6 MeV electrons, having an initial half life of 130 minutes instead of the reference constant half life of 268 minutes, which is a reduction of 51,5%.

Because In 115m having a reduction in initial variable half life of 9.7% may have been disclosed by inherence, we propose to delimit our claim to the product according to the invention by a range corresponding to an initial half life lower by at least 40% as compared to the reference constant half-life of the characteristic energy line for the metastable state of the same sort of isomer nuclides listed in the Table of Isotopes [8].

Concerning the breadth of the claims:

The one skilled in the art knows that known (i.e. non-entangled) metastable nuclides having multiple lines of energy coming from a deexcitation cascade presents a constant half life for each characteristic lines: It is obvious to the one skilled in the art that if a known (non-entangled) excited metastable nuclide de-excite to an intermediate level, that its half life is constant. The half life of the de-excitation of the intermediate level to the ground state level is also known to be constant.

If a non-entangled excited metastable nuclide is radioactive, two processes go on simultaneously:

- radio activity, which has a constant half life ($\lambda_r$) is reducing the quantity of the known (non-entangled) excited metastable nuclide available to return to the ground state of the nuclide;
- hence, the remaining quantity of known (non-entangled) excited metastable nuclide having its own constant half life ($\lambda_m$) is given by :

$$2^{(-t / \lambda r)}\ 2^{(- t / \lambda m)}$$

Which can be rewritten : $2^{(-t\ (\lambda r+\ \lambda m)/\ (\lambda r\ \lambda m))}$

Hence, it is obvious to the one skilled in the art that even a radioactive known (non-entangled) excited metastable nuclide will show a constant de-excitation half life (which is corrected by the rate of transmutation of radioactive nuclide): $(\lambda_r\ \lambda_m) / (\lambda_r+\ \lambda_m)$.

Hence, the one skilled in the art does not expect that anyone of the characteristic lines of energy of a known (non-entangled) excited metastable nuclide does present a variable half life in a standalone environment.

The variable half life in at least one line of an entangled excited metastable nuclide, or of a sample comprising at least one such metastable nuclide, is thus a unique characteristic of the product, which is directly understood by the one skilled in the art as resulting from the teachings of the application under examination.

The one skilled in the art does assess that the astonishing measurements of variable half lives in this application are the results of the entanglement of the gamma rays used to irradiate the isomer nuclide, as the two reported experiments do point specifically to the entanglement of groups of only two gammas emitted from $^{60}Co$, which is clearly stated in the application, with the corresponding experimental yield of the process leading a low variable half life, measured initially at 248 minutes (instead of 268 minutes), and to the entanglement of groups of several gamma rays from the Bremsstrahlung of accelerated electrons, which is clearly stated in the application, with the distribution of the number of entangled gammas expected in such groups, and the resulting experimental yield of the process leading to an extraordinarily highly variable half life of the product according to the invention, i.e. an initial half life measured at 130 minutes.

The one skilled in the art, having overcome its prejudice against the possibility of a variable half life of the de-excitation of excited metastable nuclides prepared according to the invention teachings, is compelled to assume that this experimental variation in the half life of an excited metastable nuclide will apply to the overall domain of metastable nuclides prepared according to the teachings of the application.

Overall, the above extract from the state of the art shows a high level of predictability in isomer nuclide properties, and owing to the particular nature of the invention disclosed of this application which is aimed at the concrete entanglement of isomer nuclides by photoactivation using entangled gamma rays, and not to the preparation of a specific isomer nuclide, granting a very narrow protection would be a denial of the guarantees provided by the United State of America constitution for the promotion of arts and sciences, and a negation of its obligation under the patent Cooperation Treaty.

Concerning the method to irradiate by using the product according to the invention as a transcient irradiation source:

MPEP 2173.05(q) "Use" Claims paragraph states that the Board held that in specific circumstances that the step of "utilizing" was not indefinite.

"**It is often difficult to draw a fine line between what is permissible, and what is objectionable from the perspective of whether a claim is definite**. In the case of Ex parte Porter, 25 USPQ2d 1144 (Bd. Pat. App. & Inter. 1992), **the Board held that a claim which clearly recited the step of "utilizing" was not indefinite under 35**

**U.S.C. 112, second paragraph**. (Claim was to "A method for unloading nonpacked, nonbridging and packed, bridging flowable particle catalyst and bead material from the opened end of a reactor tube which comprises utilizing the nozzle of claim 7.")".
[bold added]

Hence a limited use of a claimed nozzle through which catalyst particles flow has been allowed.

In some very specific circumstances a use may be allowed: this precedent shows that **a use having a step to execute the limited assumed purpose of the object** (i.e. the limited assumed purpose of an apparatus, or a source of irradiation in this case) is to be allowed **if it is limited in the sense that it substantially differs from the known use for similar objects**: In the referred precedent, the use of the nozzle was limited in the sense that the use was aimed towards the flowing of catalyst particles through the nozzle. In the present instance, the sample according to the invention is an irradiation source from which gamma rays radiate in a substantially different manner as compared to the known use of an irradiation source made of an excited metastable isomer known in the state of the art: the difference lies in that the use of the irradiation source according to the invention is limited to the delivery of a high dose of radiation initially with a half life greater than 40% from the known tables half lives, and then a lower dose of radiation.

The 40% lower limit clearly delimit the protected domain from the public domain as the product is claimed based upon a clearly measurable property by the one skilled in the art. The precedent clearly established that this is a definite claim.

Please find the following sections in this amendment:

**DESCRIPTION:** We propose to amend the description to introduce the 3 references of the state of the art discussed. Because we submitted an amendment to the description in our letter dated 2009 August 8th (to mention the original claims filed with the international application in order to provide a better support for the amended claims submitted), we propose to submit the resulting amended description as the following file:

- US01-2010-09-20-Specification-B-v01-m2.pdf

Note: the description in revision mode is given in order to help examination in file:

- US01-2010-09-20-Specification-B-v01-m2-revision.pdf

**DRAWINGS:** Unchanged.

**CLAIMS:** The claim listing begins on page 14. Claims [1-42] have been cancelled, and new claims [43-69] are submitted. The cancellation of claims [1-42] does not imply any abandonment of subject matter in the application.

**REMARKS:** Arguments and remarks are in the above text.

We are prepared to consider any further concerns you may have on patentability of our claims in order to proceed to the right protection of the invention.

This application is about a major property of nature, namely the entanglement of gamma rays obtained in specific circumstances, which has not been recognized by the scientific community due to the need to reconcile different branch of the physics knowledge without prejudices against the possibility of the invention. These prejudices are so well established that the scientific community may very well never exploit the current specification and other published information, thus missing major technological advancements for the next decades including its implication in terms of the general theories of physics.

This would be a failure of patenting system, not to promote the art and invention, as the granting of a patent in the United States of America might help the scientific community to notice this new field of research to be investigated, and lead to new developments in the major US University labs and industries. Postponing such a grant may prevent the birth of a new research domain in the US increasing the chance that it is developed abroad first.

The discovery of electromagnetic communications, and its patenting, should be reminded as to the heavy burden, which lays on the Office and its Examiners, in giving the right impulse to start a new industry at the earliest possible time considering the limited life expectancy of those who are key to such innovation.

Respectfully yours.

S-SIGNED: /Robert DESBRANDES/
Robert DESBRANDES
Inventor.

**CLAIMS:** *The following is a listing of all claims as amended with their status and the text of all active claims.*

Claims [1-42] (CANCELLED)

43) (NEW) Product comprising at least one sort of isomer nuclides being in at least one metastable state capable of deexciting by emitting gamma rays in at least one characteristic energy line, in which the half-life of said characteristic energy line is variable over time, the initial half-life, called the initial variable half life, being lower by at least 40% as compared to the reference constant half-life of said characteristic energy line for said metastable state of the same said sort of isomer nuclides, except where said sort of isomer nuclides is Niobium (99Nb41).

44) (NEW) Product according to claim 43 in which the reference constant half life has been computed for said characteristic energy line for said metastable state of the same said sort of isomer nuclides obtained by natural decay.

45) (NEW) Product according to claim 43 wherein said sort of isomer nuclides is Niobium (93Nb41m), Cadmium (111Cd48m), Cadmium (113Cd48m), Cesium (135Ce55m), Indium (115In49m), Tin (117Sn50m), Tin (119Sn50m), Tellurium (125Te52m), Xenon (129Xe54m), Xenon (131Xe54m), Hafnium (178Hf72m), Hafnium (179Hf72m), Iridium (193Ir77m), or Platinum (195Pt78m).

46) (NEW) Product according to claim 43 in which said sort of isomer nuclides is radioactive.

47) (NEW) Product according to claim 43 in which said sort of isomer nuclides is in any physical or any chemical form, for example in the form of solid in sheet or powder, or in the form of fluid or gas.

48) (NEW) Product according to claim 43 in which said sort of isomer nuclides is in the form of alloys, mixtures, or chemical compounds.

49) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Niobium (93Nb41m).

50) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Cadmium (111Cd48m).

51) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Cadmium (113Cd48m).

52) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Cesium (135Ce55m).

53) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Indium (115In49m).

54) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Tin (117Sn50m).

55) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Tin (119Sn50m).

56) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Tellurium (125Te52m).

57) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Xenon (129Xe54m).

58) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Xenon (131Xe54m).

59) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Hafnium (178Hf72m).

60) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Hafnium (179Hf72m).

61) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Iridium (193Ir77m).

62) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Iridium (193Ir77m).

63) (NEW) Product according to claim 43 in which said sort of isomer nuclides is Platinum (195Pt78m)

64) (NEW) Method to irradiate the environment of the product according to claim 43 in which one employs the aforementioned gamma rays of said characteristic energy line, as a source of gamma rays initially emitting a high dose of radiation, then a decreasing dose, and followed by a low dose of radiation for a long time.

65) (NEW) Method according to claim 64 in which the aforementioned gamma rays at a characteristic energy line are used to conduct one or more physicochemical reactions.

66) (NEW) Method according to claim 64 in which the aforementioned product is in the form of a solution.

67) (NEW) Method according to claim 64 in which the aforementioned product has undergone a physical transformation or a chemical conversion following its manufacture.

68) (NEW) Method according to claim 64 in which the aforementioned product has been prepared by using a sample comprising said sort of isomer nuclides in its ground state, said sort of isomer nuclides having said metastable state, said sample being irradiated by means of gamma rays comprising groups of two or more entangled gamma rays of a sufficient energy to photoactivate said sort of isomer nuclides of said sample to said metastable state, said sample after irradiation forming said product.

69) (NEW) Method according to claim 68 in which said sample is irradiated by said groups of two or more entangled gamma rays produced by the Bremsstrahlung of accelerated particles.